

Claims

1. A surface acoustic wave filter on the basis of interdigital single-phase unidirectional transducers (SPUDT-type), in connection with which two of such transducers (2; 3) are arranged on a piezoelectrical substrate with distributed acoustic reflection, such transducers being composed of groups of fingers (23 to 25; 33 to 35) and collector electrodes, characterized by the combination of the following features:
- (a) The totality of the fingers (231 to 233; 331 to 333) of each transducer (2; 3) forms a structure tapering in the direction of the fingers; and
- (b) The widths and the positions of the fingers are selected in such a manner that the waves reflected on the fingers (231 to 233; 331 to 333) together with the waves regenerated by the corresponding source and load resistance (8; 9) result in a lengthening of the pulse response of the filter that reduces its form factor and/or bandwidth.
2. The surface acoustic wave filter according to claim 1, characterized in that the structure is tapering in the direction of the fingers in such a manner that not only the width of equivalent fingers (231

to 233; 331 to 333) and gaps but also the intermediate space (46; 47) between the two transducers (2; 3) only vary by one and the same factor along two parallel straight lines (6; 7), whereby said lines of all fingers of both transducers intersect one another in such a manner that in each transducer, the spacings of the center lines of equivalent fingers are the same in all groups of fingers.

3. The surface acoustic wave filter according to claim 2, characterized in that in the structure tapering in the direction of the fingers, the width of the fingers (231 to 233; 331 to 333) and of the gaps located between said fingers is reduced in a step-like manner.

4. The surface acoustic wave filter according to claim 3, characterized in that all equivalent corner points (208; 209) of one and the same finger edge are disposed on a curve, whereby the straight-lined extensions (26; 36) intersect of all of said curves of the two transformers (2; 3) intersect each other beyond the corresponding finger area in one and the point.

5. The surface acoustic wave filter according to claim 4, characterized in that each finger stage contains a rectangular finger section with vertical or parallel limitations in relation to the direction of spreading in each case, whereby the two limitations extending parallel with the direction of spreading of all finger sections of the same stage in each case form a straight line of limitation, so that the finger areas disposed in each case between said two straight lines of limitation represent filter channels (201; 203; 205, 207) separated from each other by intermediate areas (202; 204; 206).
6. The surface acoustic wave filter according to claim 5, characterize in that additional collector electrodes are arranged in the intermediate areas (202; 204; 206) in such a manner that in case such additional collector electrodes belong to different transducers (2;3), no electrical connection exists between each two of said additional collector electrodes, whereby each additional collector electrode is electrically connected to a collector electrode (21; 22; 31; 32) and the fingers are connected to the additional collector electrodes in such a manner that they have the same electrical potential as if the additional collector electrodes did not exist.

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7. The surface acoustic wave filter according to claim 5, characterized in that in the intermediate areas (202; 204; 206), the electrical connection is made between equivalent finger sections of neighboring filter channels (201; 203; 205; 207).
 8. The surface acoustic wave filter according to claim 4, characterized in that all curves are straight lines (210; 310) and their extensions (26; 36) beyond the corresponding finger area of both transducers are the apparent continuation of said straight lines.
 9. The surface acoustic wave filter according to claim 4, characterized in that the straight-lined extensions (26; 36) of the curves beyond the corresponding finger area have the direction of the tangent of the corresponding curve at the borderline of the corresponding finger area.
 10. The surface acoustic wave filter according to claim 1, characterized in that each finger group (23 to 25; 33 to 35) of both transducers (2; 3) contains two fingers.

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11. The surface acoustic wave filter according to claim 1, characterized in that each finger group (23 to 25; 33 to 35) of both transducers (2; 3) contains three fingers.
 12. The surface acoustic wave filter according to claim 11, characterized in that three fingers (232; 233; and 332; 333, respectively) of each one finger group (23 to 25; 33 to 35, respectively) form a pair of fingers, whereby the fingers of a pair of fingers are equally wide and are connected to different collector electrodes (21; 22, and 31; 32, respectively), and are arranged in relation to one another in such a manner that the pair of fingers is without reflection overall and the third finger (231 and 331, respectively) is in each case a reflector finger.
 13. The surface acoustic wave filter according to claim 12, characterized in that each finger group (23 to 25; 33 to 35) is a DART-cell.
 14. The surface acoustic wave filter according to claim 12, characterized in that each finger group (23 to 25; 33 to 35) is an EWC-cell.

15. The surface acoustic wave filter according to claim 12, characterize in that the source intensity of the amplitude excitation is associated with each finger group (23 to 25; 33 to 35) by means of a source intensity function.
16. The surface acoustic wave filter according to claim 12, characterized in that a reflection factor is associated with each finger group (23 to 25; 33 to 35) by means of a reflection function.
17. The surface acoustic wave filter according to claim 16, characterized in that the reflection factor in at least one finger group (23 to 25; 33 to 35) has the opposite sign versus the other groups of fingers, such opposite sign being realized in that the spacing of the reflector finger (231; 331) of said finger group from the other groups of fingers amounts to $n\lambda/2 + \lambda/4$, whereby λ is the wavelength associated with the mean frequency along a straight line intersecting all fingers in such a manner that in each transducer (2; 3), all finger groups (23 to 25; 33 to 35) along said line are equally wide, and that ``n'' is an integer.

- See also*
18. The surface acoustic wave filter according to claim 15 or 16, characterized in that the source intensity function and the reflection function are determined by means of an optimization method.
19. The surface acoustic wave filter according to claim 15, characterized in that at least some of the finger groups (23 to 25; 33 to 35), the latter being designated as structured finger groups, are subdivided in at least one transducer parallel with the collector electrodes in a number of sub-transducers which are electrically connected in series.
20. The surface acoustic wave filter according to claim 19, characterized in that all sub-transducers of one and the same structured finger group have the same aperture.
21. The acoustic wave filter according to claim 19, characterized in that the number of sub-transducers in at least one structured finger group is different from the number of sub-transducers in the other structured finger groups.
22. The surface acoustic weave filter according to claim 12, characterized in that the widths of the fingers

(232; 233) belonging to a pair of fingers in at least one finger group (23 to 25; 33 to 35) are different from the widths in the other groups of fingers in at least one transducer (2; 3).

23. The surface acoustic wave filter according to claim 12, characterized in that the width of the reflector finger (231; 331) in at least one finger group (23 to 25; 33 to 35) in at least one transducer (2; 3) is different from the one in the other finger groups.

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